REMARKS

This amendment is responsive to the Examiner's action mailed February 15, 2002. All rejections and objections of the Examiner are respectfully traversed. Reconsideration is respectfully requested.

Claims 1-28, 51, 56-64 and 76-78 are pending.

Claims 29-50, 52-55, 65-75 and 79-81 are herein cancelled without prejudice.

Claims 1, 56, and 76 are independent.

Claims 7, 10 and 12 are herein amended.

Restriction Requirement:

The Examiner has issued a Restriction Requirement. Accordingly, Applicant herein elects claim Group I for consideration in the present application. Accordingly, the claims corresponding to Claim Group II, specifically Claims 29-50, 52-55, 65-75 and 79-81 have been herein cancelled without prejudice. Applicant reserves the right to pursue the unelected claims in subsequent applications.

Rejection Under 35 U.S.C.§ 102(b) Based on Derosier, U.S. Patent No. 5,551,248:

The Examiner has rejected Claim 1 under 35 U.S.C. § 102(b) based on Derosier '248. Derosier, however, is inapplicable to the present invention because Derosier teaches an apparatus for controlling an expansion valve in response to a sensed temperature, as disclosed at col. 10, lines 31-36. The present invention, on the contrary, determines a quantity of available refrigerant, and computes a helium allocation among plural refrigerators based on aggregate, or total, demand. Therefore, while the Derosier apparatus controls refrigerant consumption by manipulating an expansion valve of a single evaporator, the present invention computes a helium allocation among plural refrigerators to regulate consumption.

A brief review of the operation of the present invention may prove beneficial in discussing the distinctions between applicant's claimed invention and the cited references.

In the invention as defined by the present claims, cryogenic refrigerators (cryopumps) are driven by a compressor bank. An available quantity of helium refrigerant available from the compressor bank is computed. This computed helium quantity is apportioned among the cryogenic refrigerators by determining a helium allocation. This approach is beneficial because since cryogenic refrigerators may consume varying degrees of refrigerant depending on a particular function they are performing, a constant supply of helium may be excessive and inefficient. Similarly, an insufficient supply of helium may cause the cryogenic operation of the refrigerator to slow or fail altogether.

In the Derosier apparatus, a plurality of evaporators are controlled by a respective controller. The evaporators, being consumers of the refrigerant, appear to be taken as corresponding to the cryopumps described in the present application. Each controller is connected to an expansion valve in the refrigerant flow path of the evaporator which it controls (col. 4, lines 25-36). Each controller receives input from two temperature sensors, one at the refrigerant entry and one at the refrigerant exit of the evaporator (col. 4, lines 36-39 and col 6, lines 26-29). The controller periodically computes the difference between the two sensors, called superheat, across the evaporator (col. 9, lines 49-54). A second temperature parameter, superheat error, is computed from the difference between the refrigerant output from the compressor and a predetermined limit (col. 10, lines 14-29). Each controller compares the superheat of the evaporator to the superheat error to incrementally control the corresponding expansion valve (col. 10, line 42- col 11, line 7).

The control of the individual expansion valves corresponding to each evaporator is shown at the bottom half of Fig. 7 from steps 305 and 312-315. The expansion valves are controlled (315) in selected steps according to a boolean scale (col. 9, line 66-col 10, line 3). Each controller individually controls the corresponding expansion valve by stepping up or down one increment at a time, to the next larger or next smaller step size (314, 318, 321) by comparison with the superheat value. Therefore, each controller unilaterally controls the flow of the refrigerant via the expansion valve, without regard to the refrigerant called for by, or available to, the other evaporators. No determination or computation of a total available quantity, or supply, of refrigerant is performed. No determination or computation of a refrigerant allocation to a particular evaporator is performed. While the superheat error value (col. 10, line 29) appears

global, this value is derived only from the compressor discharge temperature, and bears no relevance to a total available quantity of refrigerant. No other operation of the master controller appears to be incorporated into the control of the individual expansion valves by the respective evaporator controllers.

Nowhere in Derosier '248 is shown or disclosed determining an available quantity of refrigerant and determining an allocation of the refrigerant to each refrigerator, as described above. Derosier appears to assume an unlimited quantity of refrigerant. The present claim 1, on the contrary, claims "determining an available quantity of the refrigerant" and "determining an allocation of the refrigerant" for each of the refrigerators, as recited in claim 1 and described in the specification at page 12, lines 17-21, page 13, line 20 - page 14, line 12 and page 18, lines 7-26. The allocation of the refrigerant is computed from the total available quantity of the refrigerant apportioned among all refrigerators (pumps). Therefore, the refrigerant allocation to any particular pump is computed not unilaterally, but with regard to the aggregate supply available and the demand of the other refrigerators. Accordingly, claim 1 is deemed allowable.

With respect to claim 2, "recomputing the available quantity of refrigerant" is recited. Accordingly, as Derosier does not determine an available quantity, as discussed above, recomputing the available quantity is likewise not disclosed. Therefore, claim 2 is believed allowable.

Claim 3 and 7 recite computing the available quantity in a master controller. As discussed above, the master controller in Derosier computes a superheat error based on a temperature differential. Derosier does not compute an available quantity of refrigerant. The master controller in Derosier is merely operable to incrementally adjust the compressor expansion valve in response to a sensed compressor exit temperature, as described at col. 10, lines 26-38. The Derosier master controller is not operable to compute an available refrigerant quantity. Accordingly, claim 3 and 7 are therefore deemed allowable.

With respect to claim 4, a slave controller is recited. Derosier does disclose master and slave controllers, however, as Derosier does not disclose computing a demand, computing and recomputing the demand in a slave controller is distinguished for the reasons discussed above.

With respect to claims 27 and 51, a master controller in communication with each of the refrigerators is claimed. The Derosier master and slave controllers are connected via a series

loop (col. 6, lines 13-18), and appear to communicate only with respect to the compressor output temperature. The claimed master and slave controllers are in hierarchical communication operable to communicate the allocated helium value from the master to the slave.

Further, the current computed available quantity of refrigerant differs from a measured parameter because it is operable to be adjusted up or down by a correction factor in response to operating conditions as described at page 17, lines 14 - page 18, line 6. Adjustment of this value optimizes the use of the helium refrigerant, and allows the system to compensate for operating conditions, such as ambient temperature, compressor wear and tear, and refrigerant impurities. Accordingly, claims 27 and 51 are deemed allowable.

Rejection Under 35 U.S.C.§ 102(b) Based on Eacobacci, Jr., U.S. Patent No. 5,775,109:

The Examiner has further rejected claims 56 and 76 under 35 U.S.C.§ 102(b) based on Eacobacci '109. Eacobacci '109, however, is inapplicable to the present claims because the Eacobacci '109 patent discloses a system in which temperature is monitored to reduce or halt the flow of helium, as disclosed at col. 6, lines 49-55. In Eacobacci, there are three modes of helium control disclosed. A first mode ceases operation of displacer motors to certain cryopumps to increase helium to others, allowing a thermal "coasting" type operation (col. 7, lines 5-9) . A second mode allows a refrigerator at a triggering point to warm up slightly to halt an increase in helium consumption (col. 7, lines 32-37). A third mode creates a profile for the speed of the displacer during cooling, slowing the displacer depending on the temperature of first and second stages of the refrigerator (col. 7, lines 48-61).

Eacobacci appears to control the displacer based on the temperature of the corresponding individual cryopump. There does not appear to be a computation of a total refrigerant potentially available to all cryopumps, nor an allocation of the refrigerant to individual cryopumps based on a portion of the total refrigerant available.

Therefore, nowhere in Eacobacci '109 is shown or disclosed "computing" an "allocation signal indicative of an allocation of refrigerant" and a "computed helium consumption," as recited in claim 56 and described above with respect to the Derosier patent. Further, with respect to claim 76, Eacobacci does not show or disclose "identifying the refrigeration requirements of

each of the refrigerators" and "allocating a supply of refrigerant to the refrigerators according to the identified requirements," as recited in claim 76.

With respect to claims 58, 61 and 62, the Examiner has suggested that Eacobacci discloses an allocation signal corresponding to units of mass flow rate. The Examiner cites col. 5-6 in support of this assertion. Eacobacci, however, does not show or disclose computing the mass flow rate, but rather cites an example which may result from the Eacobacci system. The present claims, on the contrary, recite that the computed allocation signal corresponds to the mass flow rate, as disclosed in the specification at page 11, line 21-page 12, line 7. Accordingly, Eacobacci does not appear to show or disclose a system which employs a mass flow rate as recited in claims 58, 61, or a computed allocation signal as recited in claim 62.

Rejection Under 35 U.S.C.§ 103(a) Based on Morishita, et al., U.S. Patent No. 6,233,948:

The Examiner has further rejected claims 1, 56 and 76 under U.S.C.§ 103(a) based on Morishita '948. Morishita, however, is inapplicable to the invention disclosed in the present application because Morishita teaches a system in which a communication network employs a network ID encapsulated in a packet to allow a single processor to communicate with a plurality of cryopumps and compressors (col. 4, lines 28-53 and col. 5, lines 1-34). Nowhere in Morishita, alone or in combination, is there a teaching or suggestion of an aggregate helium refrigerant availability or a helium refrigerant allocation, as recited in the present claims.

Morishita appears to disclose a system which employs the network to send commands to a particular cryopump by employing the network ID corresponding to a particular cryopump. A communication control section 86 prepares the packets with the network ID. The packets are transmitted via the network 37, and an I/O conversion section 76 at each cryopump watches the packets for the corresponding network ID (col. 7, lines 17-42). Morishita, therefore, appears to suggest a protocol for addressing and transmitting, or delivering, packets containing data, and does not suggest a particular method for computing or determining the data in the packets.

Accordingly, there is no teaching or suggestion in Morishita which would lead one of ordinary skill in the art to modify Morishita to achieve the invention as disclosed in the present claims because Morishita discloses a system for transmitting data, and does not teach or suggest, alone or in combination, how to compute the data contained in the packets. The present

application, on the contrary, claims computing and determining control data, specifically determining the available helium refrigerant and computing a helium refrigerant allocation to each cryopump. It is therefore respectfully submitted that the rejection under 35 U.S.C. 103(a) is improper and should be withdrawn.

Rejection Under 35 U.S.C.§ 103(a) Based on Derosier, U.S. Patent No. 5,551,248:

The Examiner has further rejected claims 5, 6, 10, 12-19, 21, and 22 based on 35 U.S.C.§ 103(a) based on Derosier '248. These claims are collectively directed to various embodiments of operation as a state machine, as shown generally in Fig. 8 and described from page 14, line 13-page 15, line 14. Specifically, these embodiments include a master controller state (claim 5), a refrigerator status and mode (claim 6), a rate of helium consumption over time (claim 10), a differential pressure (claim 12), variable rates of consumption (claims 13-14), and operating states of monitor, distribution per demand, overload, and distribution per hierarchy (claims 16-19). Derosier, however, is inapplicable to a state machine embodiment because Derosier does not teach or suggest a master controller state as employed by the present system.

In Derosier, overall control by the master controller is limited to a high compressor temperature discharge temperature subroutine, and control input limited to the compressor temperature discharge, as disclosed at col. 10, lines 16-44. Although defrost and drain modes are suggested, these are limited to timing window thresholds (col. 7, line 40-col.8-line 9). There does not appear to be any teaching or suggestion of a master controller state as recited in the present claims. Accordingly, one skilled in the art would not look to modify Derosier because the modes in Derosier are based on time, and are not based on a demand of the refrigerant by a plurality of refrigerators and on determining an allocation of refrigerant to each of the refrigerators.

Rejection Under 35 U.S.C.§ 112:

The Examiner has further rejected claim 10 under 35 U.S.C.§ 112. Claim 10 has been herein amended accordingly. Further, claims 7 and 12 have been herein amended to correct similar inconsistencies.

As the remaining claims 8, 9, 11, 20, 23-25, 51, 57, 59, 60, 63, 64, 77 and 78 all depend, either directly or indirectly, from claims 1, 56 and 76, which by the foregoing remarks and amendments are deemed allowable, it is respectfully submitted that all claims in the case are now in condition for allowance.

Information Disclosure Statement

An Information Disclosure Statement (IDS) is being filed concurrently herewith. Entry of the IDS is respectfully requested.

CONCLUSION

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned at (978) 341-0036.

Respectfully submitted,

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By____________________

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MARKED UP VERSION OF AMENDMENTS

Specification Amendments Under 37 C.F.R. § 1.121(b)(1)(iii)

Replace the paragraph at page 14, line 20 through page 15, line 2 with the following paragraph marked up by way of bracketing and underlining to show the changes relative to the previous version of the paragraph.

In the monitor state 122, the pumps 10 are polled by the VNC at each polling interval 100 to determine if any pumps 10 are operating at a limit status, described further below. A pump 10 operating at limit status is consuming at or near [it's] its maximum allowed consumption, and may need more helium to avoid warming up. A transition to the distribution per demand state 124 occurs when at least one pump 10 is reporting a limit status or when DP has dropped below a critical value. Distribution per demand 124 attempts to reallocate excess helium in the system in order to provide more helium to pumps 10 at limit, described further below with respect to Fig. 9. If distribution per demand 124 cannot reallocate sufficient helium to bring the pumps 10 out of limit status such that DP is still low, the system will transition to either an overload state 126 or a distribution per hierarchy state 128.

Claim Amendments Under 37 C.F.R. § 1.121(c)(1)(ii)

7. (Amended) The method of claim [1] 3 wherein computing and recomputing in the master [and slave] controller[s] occurs according to a predetermined set of rules and thresholds.

10. (Amended) The method of claim 1 wherein the demand is indicative of a rate of [helium] refrigerant consumption over time.

12. (Amended) The method of claim 11 wherein the at least [on] one operating parameter is a differential.